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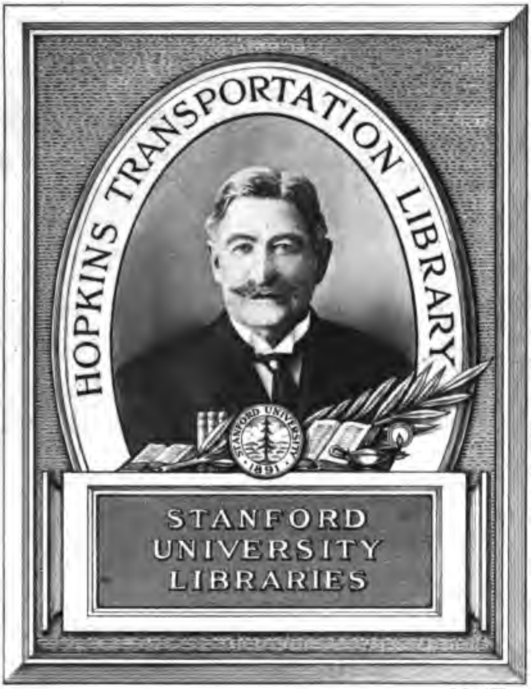
ATMOSPHERIC
TRACTION

HEWLETT

1845.

6675



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ON

ATMOSPHERIC TRACTION

IN GENERAL,

WITH

EXPLANATIONS AND ILLUSTRATIONS

OF

Pilbrow's Atmospheric Railway and Canal Propulsion.

BEING THE SUBSTANCE OF A PAPER READ BY THE INVENTOR
BEFORE THE SOCIETY [illegible] [illegible] MARCH [illegible]

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1845.

ON

ATMOSPHERIC TRACTION

IN GENERAL:

WITH

Explanations and Illustrations

OF

PILBROW'S ATMOSPHERIC RAILWAY AND CANAL PROPULSION.

BEING THE SUBSTANCE OF A PAPER READ BY DR. HEWLETT BEFORE
THE SOCIETY OF ARTS, MARCH 19, 1845.

LONDON: JOHN WEALE,
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1845.

LONDON:
BLACKBURN AND PARDON, PRINTERS,
HATTON GARDEN.

ON ATMOSPHERIC TRACTION.

Future historians will refer to the year 1845 as a period distinguished for the railway mania. The deliberations of the senate,—the calculations of the scientific,—the speculations of the adventurous,—the property of the nobleman and of the tradesman, are, to a great extent, devoted to railways. The locomotive, for some time, was supposed to be the great ultimatum for expeditious and economical traction. But this opinion has become obsolete. Can the atmosphere be made an efficient tractive? is a problem which has now been satisfactorily solved. Much praise is due to Mr. Pinkus, whose invention and perseverance contributed most effectively to the solution of the problem, and demonstrated, by the most satisfactory experiments, that his invention was as efficient in practice as it was true in theory. Contemporary with Mr. Pinkus were Medhurst and Vallance, and their views were almost simultaneously brought before the public, so that it became difficult to determine who had the legitimate claim to priority. There is the most satisfactory evidence for arriving at the conclusion that Mr. Vallance first proposed employing the power of the atmosphere against a *vacuum,* as Mr. Medhurst proposed a plenum. Twenty-four years elapsed from the time that Mr. Pinkus's views were first published, to the time when an experiment on a large scale was presented for public inspection. But since the year 1834, when Mr. Pinkus's first patent was taken out, and his first experiment tried, there have been others, who have either made some alteration in his plan of propulsion, or have proposed entirely new methods of applying atmospheric power. Among these are Messrs. Clegg and Samuda, Mr. Nikel, Mr. Pilbrow, and others of our own country; Messrs. Arago, Hallette, Chameroi, and others of France.

Numerous atmospheric systems for railways are now before the public. And the question now at issue is not, Can atmospheric propulsion be adopted? This has been answered in the affirmative, by the examination conducted by a Committee of the House of Commons for that purpose, and that Committee have given their report, highly approving the adoption of the atmospheric principle.* The question now to be determined is, Which system has the least *commercial* difficulties to encounter? And it is much to be deplored, that the Committee did not prosecute this inquiry, which might have elicited much information touching the merits of *other* atmospheric systems for railways besides Samuda's, (?)! as if *that* were the only system in existence which merited notice; the atmospheric railway has become synonymous, in the public mind, with the Samuda mode of propulsion, simply because *it* happened to be the one noticed by the House of Commons. All the expensiveness and defects of that system are ascribed to atmospheric propulsion, although other systems of atmospheric propulsion exist, with many improvements, and at less expense.

---

* Since the above was in type, namely, on the 27th June, the Committee on the Group N. have affirmed this principle by voting the Preamble of the Portsmouth Direct (Atmospheric) Railway.

If with all the weight of evidence given before the Committee, the Samuda system, with its acknowledged difficulties and expense, received commendation as superior to locomotive travelling, then if it can be shown that another system of atmospheric propulsion exist—a system possessing many advantages, which do not belong to Samuda's, and can be laid down at *less expense,* and worked *more economically,* it follows as a necessary consequence that *it* is more deserving the attention of the country than any other yet known, because the *commercial* difficulty is overcome. We do not hesitate to claim all these advantages for PILBROW'S ATMOSPHERIC SYSTEM. We most cordially recommend our readers to peruse this unpretending pamphlet with great attention. We are assured that they will rise from the investigation fully satisfied, that some of the most fertile causes of loss of power, necessity for repairs, frequent stoppages, and inconvenience in crossing roads, are avoided by Mr. Pilbrow. We shall be acquitted of all partiality when we urge, and most sincerely wish, our readers to examine for themselves.

THE DESCRIPTION.

The apparatus consists of a tube with a small square chamber above; on this chamber at given distances are small square boxes, into which a pair of spindles are perpendicularly inserted, having a small wheel at either end with oblique threads or channels on its surface; the edges of these wheels enter the chamber above the piston. Into the tube the piston is placed carrying with it an arrow, or bar, or oblique channelled rack, in the square chamber above. The progress of the piston brings the arrow between the edges of the spindle-wheels, and turns the spindles round with great velocity. This description relates to all that is *under* the surface of the road mid-way between the rails.

Above the surface of the road are the media of connexion with the moving power. The spindles have wheels at the top in every respect corresponding with those which enter the chamber below; along the centre of the leading carriage there is placed a rack, in shape and form, only rather wider, similar to the piston-rack. This rack is of sufficient length to be in two pair of pinions or spindles at the same time, and by consequence, it is never out of gear during the whole time the propulsion apparatus is acting on the carriage. The terms employed in the description may be better understood by a minute and detailed examination of the accompanying wood-cut.

DIAGRAMS OF THE CARRIAGE AND APPARATUS
OF
Pilbrow's Atmospheric System.

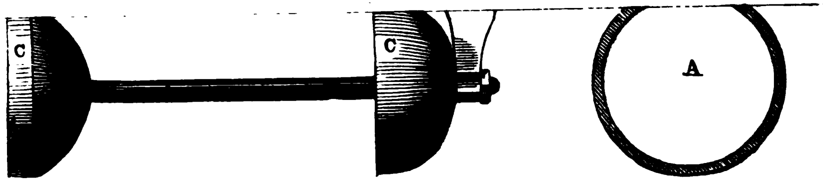
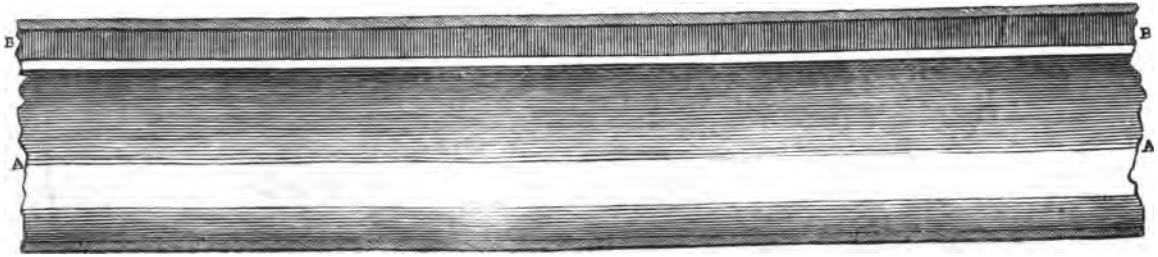


Fig. 6.



EXPLANATION OF THE FIGURES ON THE PRECEDING PAGE.

Fig. 1. Represents the whole apparatus: viz., a leading carriage, with a longitudinal section of the tube, the chamber, the piston, the piston-rack, and the air-key.

Fig. 2. A transverse section of the tube, chamber, box, and spindles.

Fig. 3. The carriage-rack and its fastenings to the crrriage.

Fig. 4. The piston with its rack or arrow.

Fig. 5. A transverse section of the tube and chamber.

Fig. 6. A longitudinal section of the tube and chamber.

A A Tube. B B Chamber. C C Piston.
D D Piston-rack. E E Spindles. F F Carriage-rack.
G G Leading Carriage. H Air-key.

After a close examination of the apparatus, there are some delicate arrangements which may escape the attention of those who have not addicted themselves to *practical* science, and yet know enough of theoretical science to anticipate difficulties. Every one who knows the first elements of Pneumatics, understands that the pressure of the atmosphere on a vessel from which the air has been removed is exceedingly great,—in exact ratio to the surface exposed. With much truth it may be said, If a vacuum be produced beneath the spindles, must not the pressure be so very great as to *resist* the piston-rack, or at least occasion a degree of friction, which must be ruinous? Admitted: the premises are sound, and the conclusion implied in the inquiry is correct. But the piston is so adjusted as to be a little in advance of the piston-rack, so that the piston passes under the spindles and destroys *in loco* the vacuum; the equilibrium being restored, the piston-rack therefore has not to contend with the super-pressure of external atmosphere.

Another difficulty is also prevented by this arrangement. As the spindles are slightly raised by the passing of the piston-rack,—it might on a *primâ facie* view be supposed, that leakage would be occasioned: from the fact above stated, the air is not admitted until *the piston* has passed, and the air rushing in *behind* the piston, that aperture, which might, in other circumstances, be the cause of leakage, is the admission of fresh air adding impetus to the piston.

In practical working on the usual scale, with the broad or narrow gauge, the spindles will be placed at intervals of thirty feet.

The tube is not exhausted directly, but by means of a pipe connecting it with a receiver of an adequate size. The receiver is exhausted by an engine-pump, and when the mercury rises to 22° the vacuum is found sufficient for practical purposes. When the receiver is exhausted, the tap of the connecting pipe is turned, which occasions all the air in the tube to rush into the receiver,—the atmosphere then presses on the surface of the piston and propels it with great velocity. This remark applies exclusively to the model now at work at the Adelaide Gallery.

In practical working, the exhausting engines will be placed at intervals of ten miles.

All that *can* be said in favour of the Samuda system has been said by Mr. Samuda himself, in evidence before the Committee of the House of Commons. We cannot help remarking, *en passant*, that it is something like an anomaly in jurisprudence to allow a man to give evidence in his own cause,—and also to allow his own avowed friends to unite in sustaining the same kind of testimony. But we pass by this, and shall present to our readers the paper Mr. Samuda put in, containing a comparative estimate between the expense of the locomotive and the atmospheric; and on the opposite page is a comparative estimate for a given distance, between Samuda's atmospheric and the Pilbrow atmospheric systems.

Comparative Expenses of Working a Line similar to the London and Birmingham, 112 miles long, with the present Traffic.

SAMUDA'S ATMOSPHERIC.

	£
Wages.—34 Stations, at each—	
2 Engine-drivers, at 6s. 2 Stokers, at 3s. (This allows a relief set for night)	10,512
Of Train Conductors, 15 men, at 30s.	1,170
Coal.—Each engine burns 500 lbs. per hour, and works 9 minutes for each train :— $\frac{500 \text{ lbs.} \times 9\text{lbs.}}{60}$ = 75 lbs. usefully burnt. 37·5 lbs. 50 per cent. for waste. 112·5	
112·5 × 33 engines × 30 trains = $49\frac{2}{3}$ tons per day × 365 = 18,148 tons, at 9s.	8,166
Repairs to Engines, Oil, Hemp, Tallow, &c.—£200 per station per annum—£200 × 34.	6,800
Renewal of Travelling Apparatus	1,573
Superintendents, Foremen, &c.	2,000
= about 5½d. per train per mile,	£30,221

LOCOMOTIVE.

		£
Wages.—Engine and Firemen.		9,676
Coke.		25,541
Repairs, &c.	£23,986	
——— for Camden Town Engine.	1,491	
		25,477
Half Reserve Fund for Depreciation		14,000
Superintendents, Foremen, &c.		4,634
		£79,328
Expenses of Atmospheric.		30,221
Showing a clear saving of Atmospheric over Locomotive of.		£49,107

Comparative view of Expenses of working a Line similar to the London and Birmingham, 112 *miles long, with the present Traffic.*

ON PILBROW'S ATMOSPHERIC SYSTEM.		ON SAMUDA'S ATMOSPHERIC SYSTEM.	
	£		£
First item	4,000	First item	10,512
Second do.	1,170	Second do.	1,170
Third do.	3,022	Third do.	8,166
Fourth do.	2,266	Fourth do.	6,800
Fifth do.*	548	Fifth do.	1,573
Sixth do.	1,800	Sixth do.	2,000
	£12,806		30,221
		Expenses of working 112 miles on Pilbrow's Atmospheric.	12,806
		Showing a clear saving of	£17,415

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* N.B. Having no long valve to keep in order or supply with Composition, we have simply to renew piston leathers and wear of racks, &c.,—so that about £547. 15*s*. will be an ample amount for the Fifth item.

Now the saving of expense in the Pilbrow system is so much greater, because twelve stationary engines would be a very ample competence for the same distance, and then upon the most liberal calculation upon the same ratio £4000 would be sufficient, and give a clear saving of £6512. Let the second item of expense stand as it does, at 1170, though we believe it is more than would be required. The next item may be fairly put down at £3022. The next item must be reduced upon a larger scale, since in the Pilbrow system no hemp, oil, nor tallow will be required for valvular accommodation, and one cause of expense in repairs, viz., the longitudinal valve, will be avoided; therefore, on the most liberal scale, the allowance for repairs may be put down at £2266, and the other two items may be put down respectively at £548, and £1800. Admitting the scale of the estimate to be correct, here is a clear showing of saving over the locomotive system of £66,522, while the Pilbrow system shows a saving above the Samuda plan of £17,415. We beg to call the attention of our readers to an extract from Mr. Pilbrow's pamphlet:—

"Comparative advantages of Pibrow's Invention over the *present* Atmospheric system:—First,

"IN CONSTRUCTION.

"1. In having no discontinuance of the 'main,' and therefore no 'section valves,' &c., at crossing of roads, lanes, &c.

"II. In having no necessity for bridges for cross lines, roads, lanes, &c.

"III. In having no continuous valve, with all its complication, and necessary care in fitting, composition, &c.

"IV. In having fewer engine establishments, one to every *ten miles* being sufficient, instead of one to every *three miles;* thus saving *twenty-three engines*, &c., out of every thirty-four in 100 miles. The reason why a less number will be required on this plan than the other, is, that there being no long valve here, the leakage will be so diminished that it will amount to less in ten miles than now in one; it is estimated that now the leakage equals 5-horse power per mile, and therefore, should there be but one engine to ten miles of main, 50-horse power out of the 100 would be lost for leakage alone; so it is found absolutely necessary to have one engine every three miles, thus reducing the loss to 15-horse power out of the 100. Why the pinion-valves as proposed will not leak so much as the long valve is, first, because the surfaces are ground truly, and are pressed together by the weight and fall of the pinion, (and the more used the better they will stop;) and secondly, on account of the small quantity of surface or space *that can leak*, the proportion being as one to twenty between the two systems, for the pinion-valve or seat being about nine inches in circumference at the aperture where the air is admitted, and being only two of them to every thirty feet of main = 1·5 feet, whereas the present long valve would be the whole *thirty feet* exposed and liable to leakage; hence, even were the pinion-valves to leak as much as the long valve, *surface for surface*, this plan would only leak 2½-horse power instead of 50-horse power in ten miles!

"V. In there being no necessity for the main to be cast thicker at the lower part than at the top, for strength, as now, the tube being with an open groove along its top; when therefore a vacuum is made within, the superincumbent atmosphere pressing all round the tube, has so large a surface to act upon, and so strong a tendency to press these edges together, that it is found necessary to cast the 'main' much thicker and heavier at the lower part and altogether than otherwise would be requisite, if it were without any cut or open groove.

"VI. In having no necessity for the 'heating apparatus.'

"VII. In having no necessity for 'cranes,' or elevated rails, for the taking on and off carriages, as that would be done in the usual manner, &c.

"VIII. In that this arrangement will permit of the 'main' being varied in its diameter at different parts of a long line, to suit any irregularity in the general level or gradients, or traffic, which is often greater at one part than at another, so that, for instance, the tube from this crossing to the next might be fifteen inches in diameter to suit a generally steep inclination or heavy local traffic; and the tube to the next crossing in the opposite direction might be only ten inches, sufficient perhaps for a nearly level way or light traffic—an advantage not only in convenience, but in first outlay and construction:—Secondly,

"IN SAFETY, AND THEREFORE GREATER POPULARITY.

"I. In there being no necessity for a discontinuance of 'main' between the stations; therefore—

"II. In the fact that the piston will never leave one part of the main and enter another at full speed.

"III. In there being no section valves under the doubtful control of an attendant, or the liabilities of machinery to get out of order, (and so not act at the *instant* required,) which neglect or accident would be attended with the most fearful concussion and consequences.

"IV. In the piston never leaving or entering a 'main' but at a station where it is required to stop.

"V. In no liability of obstruction or destruction, by snow, frost, and bad weather.

"VI. In being able to retard trains in descending inclines, by not lifting the valves, and thus rarefying the air behind the piston.

"VII. In the ability, in case of stoppage or accident between stations, to disengage the piston, and thus send that information to the next station, and then the facility by which a carriage, containing men and tools, &c., can be dispatched to their assistance :—Thirdly,

"IN SIMPLICITY.

"I. In having no heating apparatus and composition.

"II. In having no long valve, or section valves, between stations, bridges, &c.

"III. In having so few engine establishments, &c. &c.

"In being able, without any alteration from the present mode, and without cranes, or elevated rails, to remove or place carriages upon the line :—Fourthly,

"IN CHEAPNESS OF FIRST OUTLAY.

"I. In requiring fewer engine establishments.

"II. In requiring no bridges, &c., for crossing of roads, &c.

"III. In greater simplicity and lightness of 'main.'"

As to the saving of expense in the first outlay, it will be shown, according to the accompanying estimates, that the saving of Pilbrow's system is about £850 per mile.

Samuda's Estimate for laying per mile.

	£.
Main, (15-inches diameter)	1632
Long valve, &c.	770
Composition for lining and valve	250
Planing, drilling, &c.	295
Laying, jointing, &c.	295
Station valves, and piston apparatus	100
	£3342*

The saving in the above may be safely taken thus :—

	£.
In main, (less weight, &c.)	200
In difference of cost of long valve and pinions	375
Difference in composition (being none required for the long valve)	125
In planing, drilling, &c. (which must be wholly connected with the long valve)	150
	850 × 100 miles £85,000

Thus showing a difference, *in first outlay*, in favour of Pilbrow's patent over the present "atmospheric railway" apparatus, in 100 miles, no less a sum than £300,000; and in which it is presumed there can be no difference of opinion, when the two plans are examined and compared, even by the most partial or sceptical.

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* See Mr. Samuda's Evidence before the Committee of the House of Commons.

We have thus given a comprehensive view of the whole system by the inventor himself; and we are sure that our readers will admit that we have not overrated the invention by our preceding remarks. And if any doubt existed whether the preceding remarks were altogether impartial, that doubt must be most effectually removed, by the candid statement in the *Times*, the leading journal in Europe,—a paper not accustomed to propagate opinions which will not bear the utmost scrutiny. After giving a very lucid description of the whole of the apparatus, the writer observes:—

> "This description must suffice for the present; it will at least have the effect of rousing public attention to a very important, and as far as the limited experiments have shown, an efficacious invention. That the atmospheric principle will ultimately, and perhaps at no very distant period, supersede the cumbrous and dangerous locomotive engines, seems almost certain. It therefore, in the present state of railway conveyance, is almost a duty for all persons to make themselves acquainted with the merits of various inventions of this kind; a written description cannot suffice, even with diagrams which cannot be given in a public journal, nor are they necessary when the working and practical operations of the invention can be learned and comprehended by examining the models. The trite adage,
>
> 'Segnius irritant animos demissa per aures
> Quam quæ sunt oculis subjecta fidelibus,'
>
> is here applicable, and the best interpretation of it is to go and see what the model is doing at the Adelaide Gallery."

Many objections have been raised against the practical working of Pilbrow's system because of certai difficulties which were apprehended. It may be useless to enumerate those objections, and refute them *seriatim*, since the reader may now easily satisfy himself that those difficulties had no existence, but in the imagination of the objector. At the Adelaide Gallery, the reader may now examine the whole apparatus at work, and have experimental demonstration of its efficiency, by riding in the car propelled by the Pilbrow Atmospheric system.

It will be to the honour of the country, if those companies about to construct railways were first fully to investigate and then to adopt the Pilbrow Atmospheric, and prove its superiority over that of Samuda's, and thus confer a benefit on society, by facilitating cheap travelling without any danger of the recurrence of those dreadful collisions and other awful accidents which every week appear in the public journals. Two causes of the most fearful accidents are avoided by the atmospheric principle, viz. that of *collision*, as it is impossible there can be two vacua in opposite directions and on the same line; and that of *running off the line*,—as the carriage-rack, upon which the propelling power acts, must of necessity keep the carriage in its proper place.

Every company is bound to take the plan most conducive to the public good. We know from high authority, that "the *mode of traction* to be employed on lines of Railway, forms no part of the provisions of the Bill, —and that any Railway Company, new or old, is at liberty to adopt the Atmospheric, locomotive, or any other principle which may be devised, at pleasure, without any application to Parliament." Travelling by Pilbrow's Atmospheric Railway may be accomplished by the invalid without injuring his health by offensive vapours, or perturbing his nerves by the immense momentum of a ponderous engine and tender, which render immediate stopping almost impracticable. Provision is made ordinarily for stopping the carriage *ad libitum*, by the *break;* and on extraordinary occasions by an opening valve similar to a flute key, which can be opened by a slight depression of the carriage-rack under the control of the conductor. The other advantages of this system which are common to the other system of Atmospheric propulsion, are the avoidanceof smoke, steam, and falling flakes of fire,—the impossibility of collision,—the rapidity of progress over gradients of considerable height,—and the extraordinary saving of expense.

Without entering minutely into particulars, it may be sufficient to state, that the same principle is available for propelling boats on canals; and if canal property is ever to return to its original value, it is more likely to do so by the adoption of this principle than by any other means which has yet been devised.

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